Bolandia (Asteraceae, Senecioneae): A New Genus Endemic to Southern Africa

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Abstract. The genus *Bolandia* (Asteraceae, Senecioneae) comprises two known species, *B. pedunculosa* and *B. argillacea*, previously included in *Cineraria*. Distinguishing features of *Bolandia* include the fusiform shape of the cypselae and strong median rib on the glabrous inner surface of the ray and outer disc cypselae, solitary ecalyculate capitula on long peduncles, and a truncate style apex with a central tuft of sweeping hairs. *Bolandia* occurs in the mountains of the Western Cape in southern Africa, with a disjunct population of *B. pedunculosa* in the Witteberg of the Eastern Cape and the nearby Drakensberg mountains in Lesotho. *Bolandia argillacea* is endemic to the mountains near Worcester in the Western Cape. Two forms of *B. pedunculosa* are informally recognized, a tomentose and a glabrescent form, the latter including plants previously known as *C. albomontana*.

Key words: Asteraceae, *Bolandia*, *Cineraria*, Compositae, Senecioneae, Western Cape.

The tribe Senecioneae of the Asteraceae is well represented in southern Africa, with about 19 genera (mostly senecioid), eight of which contain three or fewer species (Bremer, 1994). Many of these genera and species are found in the Western Cape and/or montane regions. *Bolandia* Cron is another such genus, comprising two species previously included in *Cineraria* L., namely, *B. pedunculosa* (DC.) Cron and *B. argillacea* (Cron) Cron. Separate and combined molecular (ITS and *trn*L-*trn*F regions) and morphological analyses (Cron, 2005; Cron et al., in prep.) have established this pair of species as a sister-group to the monophyletic and morphologically coherent, revised genus *Cineraria*.

Compression and shape of the mature cypselae are important diagnostic characters of the genus *Cineraria*, along with other features such as the palmate venation of the usually auriculate leaves and radiate, calyculate capitula. Although de Candolle (1837–1838) included the type species for *Bolandia*, *B. pedunculosa*, in *Cineraria* (*C. pedunculosa* DC.), he expressed doubt concerning its placement: "*An genus proprium*?" (1838: 305), noting that its fruits were not truly compressed. Harvey (1865) placed this species in *Cineraria* sect. *Cineraria*, noting that the young cypselae were compressed. However, cypselae of many genera of Senecioneae appear compressed when immature, and other morphological features also serve to unequivocally distinguish *Bolandia* from *Cineraria*.

Bolandia occurs mainly on the mountains of the Western Cape, in the vicinity of Worcester and also in the Ceres, Clanwilliam, Laingsburg, and Swellendam districts (Fig. 1). This part of the Western Cape includes an area often referred to among the local population as the "boland," an Afrikaans term meaning "highlands" and pertaining to a region that includes the original Western Province, namely, the magisterial districts of the Cape, Stellenbosch, Worcester, and Swellendam as they existed at the time of the Cape Colony (Potgieter, 1975). The distribution of *Bolandia* includes mountain ranges in and around this region. A disjunct population of *B. pedunculosa* in the Witteberg of the Eastern Cape and adjacent Lesotho extends the distribution of the genus beyond the Western Cape (Fig. 1).

Bolandia pedunculosa was first described by de Candolle (1837–1838) in his *Prodromus Systematis Naturalis Regni Vegetabilis* and subsequently by Harvey (1865) in *Flora Capensis*. Below is a more detailed description than provided in either reference.

Bolandia Cron, gen. nov. TYPE: *Cineraria pedunculosa* DC., Prodr. 6: 305. 1838. [= *Bolandia pedunculosa* (DC.) Cron].

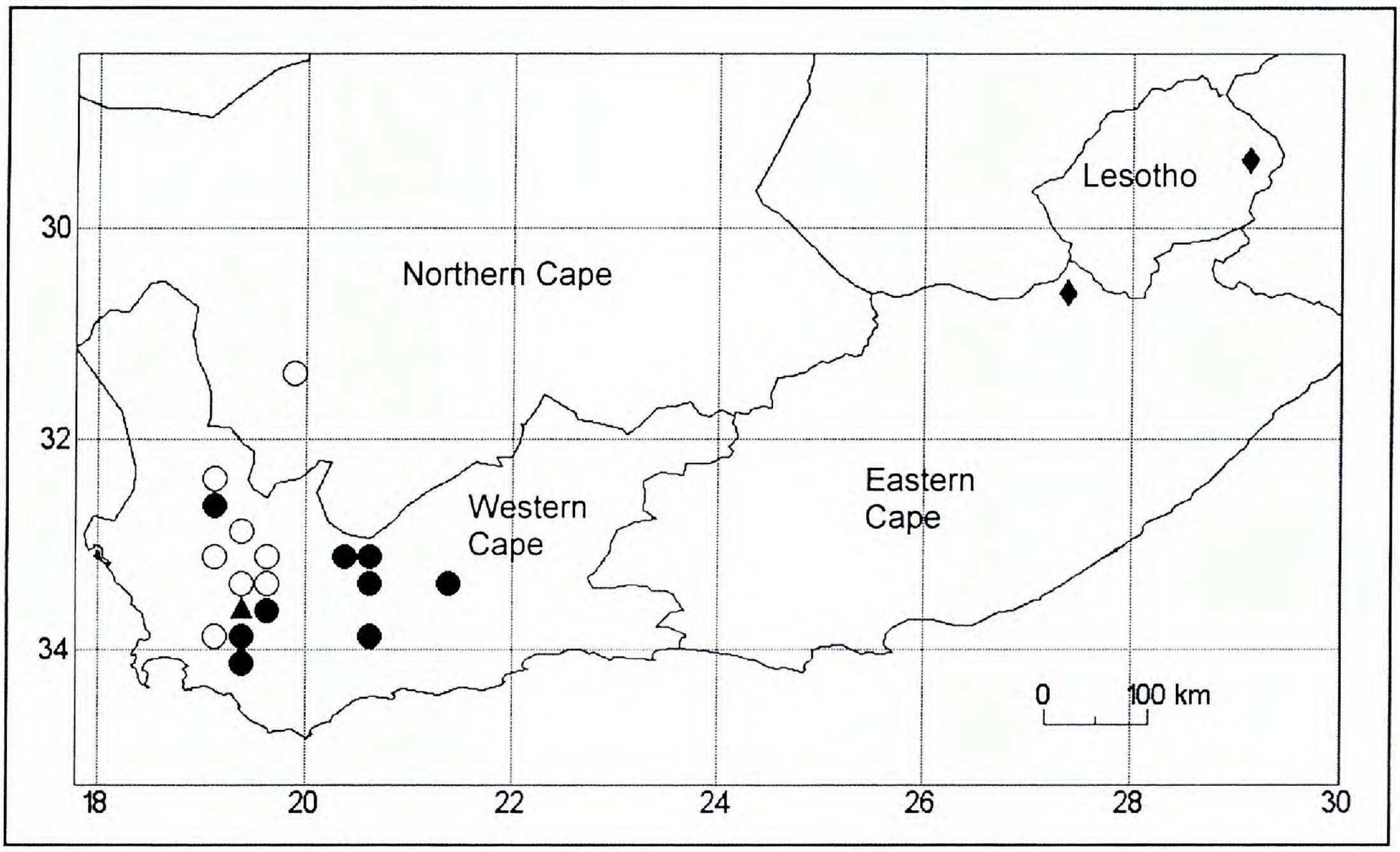

Figure 1. Map of known distribution of *Bolandia*. *Bolandia pedunculosa*: ● tomentose form, ○ glabrescent form, ◆ glabrescent form with predominantly obovate leaves (previously known as *Cineraria albomontana*); ▲ *B. argillacea*.

Cinerariae L. valde affinis, sed involucro ecalyculato et apice ramis stylorum discorum flosculorum truncato atque cypselis non compressis, fusiformibus non obovatis, cypselis exterioribus triangularibus, cypselis discis interioribus quadrangularibus, foliis pinnatinervibus, non palmatis, exauriculatis differt.

Perennial or annual herbs, branching mainly from the base or stoloniferous. *Leaves* alternate, simple, lyrate pinnatifid, pinnatisect, or non-pinnatifid, ovate to elliptic or obovate in outline, cobwebby or tomentose, glabrescent. *Peduncles* long, bracteate, monocephalous; *capitula* heterogamous, radiate, ray florets female, disc florets hermaphrodite; *involucre* ecalyculate, phyllaries uniseriate, with scarious margins, tomentose or cobwebby and glabrescent. *Ray florets* female, with glandular trichomes on tube near base of limb; corolla of disc florets tubular below, upper third campanulate with 5 lobes, with median resin duct, apically papillate; *anthers* with obtuse, triangular to ovate apical appendages, bases minutely sagittate, filament collar gradually widening toward the base (balusterform), endothecial walls radially thickened. *Styles* of disc florets with discrete stigmatic areas, style apices truncate with a central tuft of acute-tipped sweeping hairs and fringing apex, style base shortly campanulate. *Cypselae* narrowly fusiform to elliptic, dimorphic; ray cypselae and outer disc cypselae with prominent inner median rib, triangular in cross section, convex outer surface, inner surfaces of ray cypselae glabrous, outer surfaces covered with short white mucilaginous twin hairs, disc cypselae pubescent all over, quadrangular in cross section; carpopodium distinct, 4 to 6 rows of cells; *pappus* bristles pluriseriate, delicate, scabrid, caducous.

Species 2, South Africa (Western and Eastern Cape), Lesotho.

KEY TO SPECIES OF *BOLANDIA*

1a. Leaves pinnatisect . . . . . *B. argillacea*
1b. Leaves non-pinnatifid and ovate to elliptic to obovate or lyrate pinnatifid . . . . . *B. pedunculosa*

1a. Bolandia argillacea (Cron) Cron, comb. nov. Basionym: *Cineraria argillacea* Cron, S. African J. Bot. 63: 402. 1997. TYPE: South Africa. Western Cape: Worcester District, on slopes at base of Brandwacht Peak, 12 Nov. 1978, *E. Esterhuysen 35117* (holotype, BOL; isotypes, K, S, UPS).

Annual erect herb (or possibly persisting for more than one season), 30–50 cm tall; *stems* woody and sometimes branching near the base, finely tomentose, glabrescent toward the base, then reddish brown in color. *Leaves* pinnatisect, green, elliptic to ovate or oblanceolate in outline, lamina 18–33 × 14–24 mm, lobes 4–11 × 0.8–3.0 mm, cobwebby above and below, glabrescent with age; apex extremely acute;

margins dentate, apex of lobes and teeth tipped reddish purple; base cuneate and decurrent along petiole; petiole 8–35 mm long, occasionally with lateral pinnae along length, cobwebby; exauriculate, sometimes widening slightly at base to clasp stem. *Capitula* heterogamous, radiate, solitary on terminal peduncles; peduncles 130–175 mm long, cobwebby, glabrescent, bracteate (bracts 2–6(−13) mm long); *involucre* ecalyculate, phyllaries 10 to 12, 5.5–6.5 mm long, woolly at the base, glabrescent toward the tips, margins membranous. *Ray florets* 6 to 9, commonly 8, 8.5–10.5 mm long, limb 6–8 mm long, 5-veined. *Disc florets* 18 to 32, corolla ca. 4.5 mm long. *Cypselae* narrowly oblong to fusiform, dimorphic, ray cypselae 3-angled with prominent median rib on inner surface, outer surface of ray cypselae convex, inner surface glabrous, outer surface of ray cypselae covered with short white mucilaginous twin hairs, disc cypselae subcylindrical, pubescent on inner and outer surfaces, black when mature, 4.5–5.2 mm long; *pappus* 3/4 length of mature disc floret, caducous.

Phenology. Flowering in October and November.

Distribution. South Africa, in the Western Cape, apparently endemic to the slopes below Brandwacht Peak in the mountains near Worcester.

Habitat. Bolandia argillacea is reportedly restricted to the clay zones on the mountain, growing in association with *Erica leucanthera* L.f., but not extending into the renosterbos (shrubland dominated by *Elytropappus rhinocerotis* (L.f.) Less.). It grows at 1700–1800 m on the southeastern and eastern slopes of the mountain.

Conservation status. Due to its very restricted distribution and occasional occurrence in its particular habitat, *Bolandia argillacea* is considered to be Vulnerable VU D2 (J. Victor, pers. com.), using IUCN (2001) criteria. Its habitat is not likely to be threatened by human activities, but its continued existence may well be threatened by climate change.

Specimens examined. SOUTH AFRICA. **Western Cape**: Worcester District, slopes at base of Brandwacht Peak, along path toward Fonteintjiesberg, *Esterhuysen 36192* (BR, E, K, US); Brandwacht, clay slopes at foot of Chavonnesberg, *Esterhuysen 8195* (BOL).

1b. Bolandia pedunculosa (DC.) Cron, comb. nov. Basionym: *Cineraria pedunculosa* DC., in Prodr. 6: 305. 1838. TYPE: South Africa. Western Cape: Caledon, Potrivier, Langehoogde, Bontjeskraal, bis am Zwarteberg, 165–660 m, July 1835?, *C. F. Ecklon & C. L. P. Zeyher 1519* (holotype, G-DC; isotype, S). Figure 2.

Cineraria albomontana Hilliard, in Notes Roy. Bot. Gard. Edinburgh 45: 185–187. 1989. Syn. nov. TYPE: South Africa. Eastern Cape: Lady Grey, Witteberg, Joubert's Pass, 2465– 2530 m, 18 Jan. 1979, *O. M. Hilliard & B. L. Burtt 12177* (holotype, E; isotypes, K, NU, S).

Perennial herb, up to 30 cm tall, with a vertical woody rootstock; *stems* woody at the base, branching occasionally from the base, white tomentose, nodes very close together. *Leaves* non-pinnatifid, ovate to elliptic to obovate, or lyrate pinnatifid, deeply to shallowly lobed with terminal lobe ovate to elliptic or obovate in outline, usually with 1 or 2 pairs of lateral pinnae, lamina 11–32(−73 in glabrescent form) × 8–27 mm, cobwebby above, usually glabrescent, tomentose or cobwebby and glabrescent below; apex rounded; margin dentate to crenate with apiculate tips; base cuneate and decurrent or truncate to slightly cordate; petiole (14–)23–55 mm (−86 mm in glabrescent form) long, cobwebby to tomentose; auricles absent, petiole widens somewhat at base to clasp stem. *Capitula* heterogamous, radiate, solitary, axillary; peduncles (30–)80–240 mm (−330 mm in glabrescent form) long, cobwebby, glabrescent, conspicuously bracteate, bracts (2–)5–11 mm long; *involucre* ecalyculate, phyllaries 8 to 14(to 15), 5–7 mm (−9 mm in glabrescent form), cobwebby to tomentose, glabrescent, margins scarious. *Ray florets* 8 to 11, 8.0–9.5 mm long, limb 6–8 mm long (5–12 mm in glabrescent form), 4-veined (mostly 5- or 6-veined in glabrescent form). *Disc florets* (25 to)30 to 55, corolla 4.5–5.0 mm long (−6.0 mm in glabrescent form). *Cypselae* fusiform, dimorphic; ray cypselae 3-angled with prominent median rib on inner surface, inner surface glabrous, convex outer surface covered with short mucilaginous white twin hairs, compressed when young, black when mature, ca. 4 mm long; disc cypselae subcylindrical (outer ones with prominent inner median rib), 4-ribbed when mature, black with short white twin hairs all over, 3–4 mm long; *pappus* scabrid, 3/4 length of disc floret corolla, caducous.

Phenology. Flowering mainly from September to November (to January in glabrescent form), rarely as early as August.

Distribution. South Africa, Western Cape: the tomentose form occurs in the Witteberg of the Laingsburg District, in the Keeromsberg near Worcester, and near Barrydale in the Swellendam districts; the glabrescent form occurs on the summit of Milner's Needle in the Hex River Mountains, on Du Toits Peak near Worcester, in the Baviaansberg (Ceres District), and in the Cederberg (Clanwilliam District). The glabrescent form also occurs in the Witteberg near Lady Grey in the Eastern Cape and

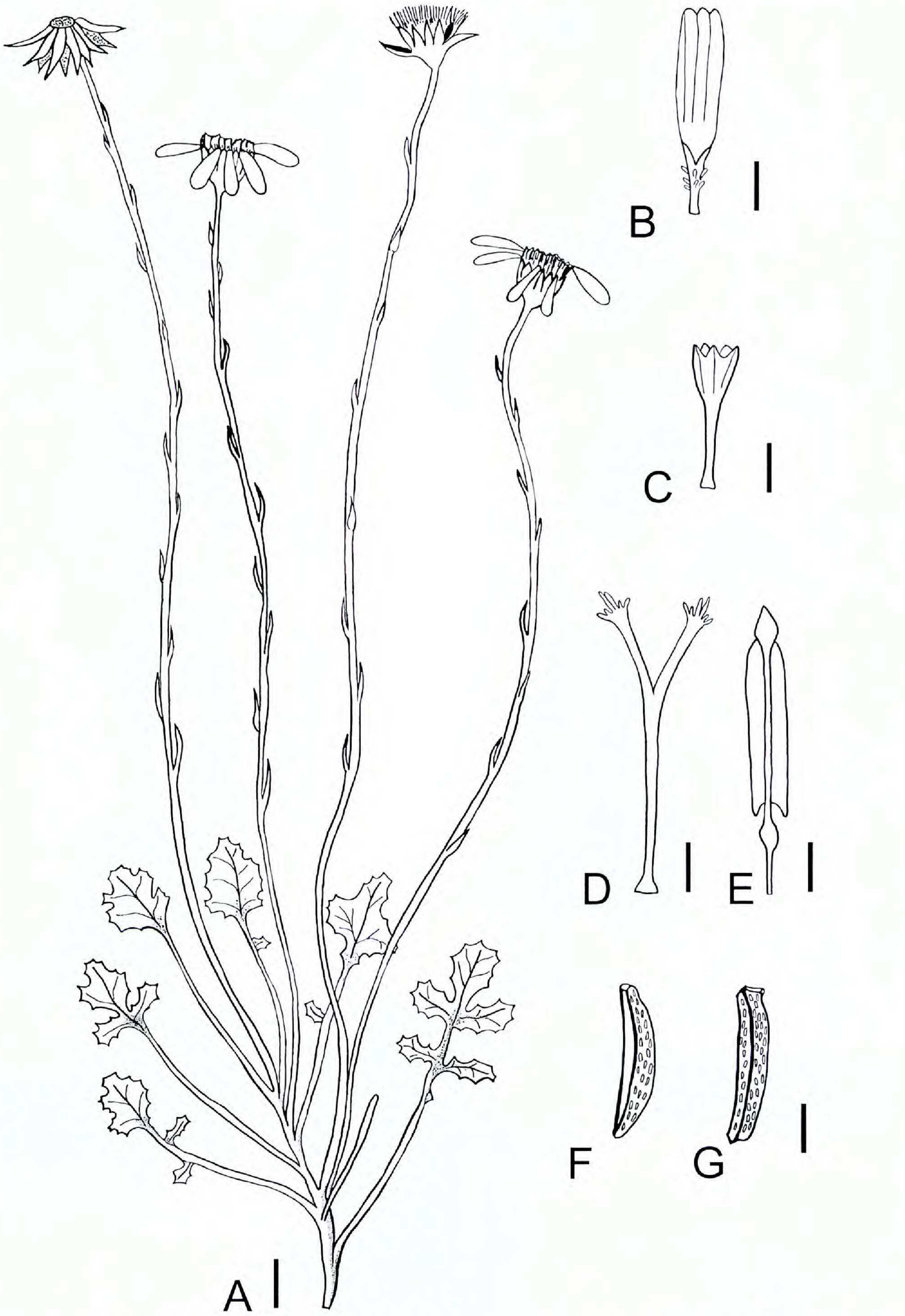

Figure 2. Illustration of *Bolandia pedunculosa*. —A. Habit. Scale bar = 13 mm. —B. Ray floret. Scale bar = 2.0 mm. —C. Disc floret. Scale bar = 2.1 mm. —D. Style. Scale bar = 500 µm. —E. Stamen. Scale bar = 500 µm. —F. Ray cypsela. Scale bar = 1.3 mm. —G. Disc cypsela. Scale bar = 1.3 mm. Drawn from *Compton 2772* (BOL, K).

on Thaba Ntlenyana in Lesotho, these eastern populations being previously treated as *Cineraria albomontana* (Hilliard, 1989).

Habitat. Growing in dense clumps on steep, stony south- or southeast-facing slopes, between grass tussocks, at the base of cliffs, among rocks or on rocky summits, on shale bands, in sand or on basalt, with the tomentose form mainly at an altitude range of 1000–1500 m, and the glabrescent form ranging from 1650–2300 m in the Western Cape and 2450–3350 m in the Eastern Cape and Lesotho.

Conservation status. Localized, not common. Possibly rare, but of Least Concern, applying IUCN (2001) criteria.

Selected specimens examined. **Tomentose form**: SOUTH AFRICA. **Western Cape**: Wuppertal, Duiwelsgat, S Cederberg, Sneeuwberg, *Esterhuysen 13104* (BOL); Worcester, Keeromsberg, *Esterhuysen 26629* (BOL); Villiersdorp, Caledon, *Esterhuysen 4870* (BOL); Tweedside, *Keary 4127* (BOL), *Compton 3110* (BM, BOL), *Compton 3111* (BOL); Bantams Karoo, *Compton 12241* (NBG); Witteberg, S of Bantams, *Esterhuysen 30520* (BOL); Laingsburg District, Witteberg, *Compton 2722* (BOL, K), *Compton 21140* (NBG); Witteberg, Fisantekraal, *Compton 21108* (NBG); Witteberg, Whitehill, *Compton 13922* (NBG), *Compton 16263* (NBG); Swellendam District, near Barrydale, *Barker 5398* (NBG); Ladismith District, Seven Weeks Poort, *Phillips 1468* (SAM); Zwartberg, Caledon, *Zeyher s.n. sub SAM 16975*. **Glabrescent form**: LESOTHO. Thaba Ntlenyana, *Guillarmod 2325* (PRE). SOUTH AFRICA. **Eastern Cape**: Lady Grey, Witteberg, Joubert's Pass, *Hilliard & Burtt 12177* (K, S), *Cron & Goodman 544* (J). **Northern Cape**: Calvinia, Ekerdam, *Taylor 2686* (BOL); Clanwilliam, Cederberg Mts., Peak S of Sneeuwkop, *Esterhuysen 7547* (BOL); Cederberg, Sneeuwkop, *Stokoe s.n. sub SAM 57134*; Cederberg, Sneeuwberg, *Esterhuysen 18045* (BOL); Ceres, Bokkeveld, Tafelberg, *Esterhuysen 3918* (BOL). **Western Cape**: Tulbagh, Great Winterhoek, *Esterhuysen 27004* (BOL); Worcester, Milner's Needle, Hex River Mts., *Esterhuysen 14880* (BOL); Ceres, Baviaansberg, W of Karoopoort, *Esterhuysen 29858* (BOL); Roodeburg, Hex River Mts., *Esterhuysen 20924* (BOL); Worcester, Du Toits Peak, *Esterhuysen 8583* (BOL).

A number of specimens that constitute a much more glabrescent form are considered here to match *Bolandia pedunculosa*. A collection by Esterhuysen [*26629* (BOL)] from the Keeromsberg in the Worcester District of the Western Cape has both glabrescent and tomentose forms present. Increased glabrescence is linked to higher altitude and also slightly larger capitula in *B. pedunculosa*. Included in this glabrescent form of *B. pedunculosa* is *Cineraria albomontana* Hilliard from the Witteberg of the Eastern Cape, South Africa, and Thaba Ntlenyana in Lesotho. Both tomentose and glabrescent forms have a range of leaf shape, varying in degree of lamina dissection from entire to lyrate-pinnatifid with two to four pairs of lateral pinnae below the terminal lobe.

Distinguishing features of *Bolandia* include the shape and surface features of the cypselae, capitula arrangement and style branch apices. The solitary capitula are borne on long peduncles and the involucre is ecalyculate (Fig. 2A). The apex of the branches of the style of the disc florets is truncate with a fringe and a central tuft of sweeping hairs (Figs. 2D, 3C). The cypselae are fusiform to elliptic in shape and are heteromorphic (Fig. 2F, G). Mature ray cypselae have a strong median rib on the inner surface, which is glabrous, the outer surface being convex and covered in short white twin hairs (Fig. 3A, B). The disc cypselae are mostly cylindrical (terete in cross section), although the outermost ones may be markedly curved with a prominent inner median rib as in the ray cypselae, but all disc cypselae are pubescent on inner and outer surfaces. As in *Cineraria* and many of the Senecioneae, the anthers have ovate apical appendages and balusterform collars (Fig. 3D).

In contrast to *Bolandia*, *Cineraria* has obovate, laterally compressed cypselae with distinct margins or wings, a calyculate involucre on capitula that are commonly borne in lax cymes or corymbs of few to many capitula, and an obtuse style apex that has a fringe of sweeping hairs, as well as a central tuft. In addition, the distinctive palmate venation and lobing of the auriculate leaves of *Cineraria* is not seen in leaves of *Bolandia*, which are pinnately-veined, ovate to elliptic to obovate in outline and exauriculate. Furthermore, the epicarp cells of cypselae in *Cineraria* are sub-isodiametric, whereas those of *Bolandia* are more elongate.

Characters shared by *Bolandia* and *Cineraria* include a distinct carpopodium, although it is generally larger in *Cineraria* (8 to 14 rows of cells) than *Bolandia* (4 to 6 rows of cells), glandular trichomes on the ray florets, and the central tuft of sweeping hairs on the disc styles (present in most species of *Cineraria*). Leaf trichomes in *Bolandia* have two to four narrow basal cells and a multi-celled long apical appendage, attached obliquely to the basal cells. This type of trichome is common in the Senecioneae and is also present in some species of *Cineraria* (e.g., *C. albicans* N. E. Brown).

Mesogramma apiifolium DC., a recently reinstated monotypic genus (Nordenstam & Pelser, 2005) that includes *Cineraria microglossa* DC. (Nordenstam & Cron, in prep.), has cypselae morphologically similar to *Bolandia*. Other characters in common between *Mesogramma* and *Bolandia* are their herbaceous habit and the resin ducts in the involucral bracts. *Mesogramma* DC. differs from *Bolandia* in its lack of tomentum, the calyculate involucre, and glabrous ray floret tubes (Nordenstam & Pelser, 2005; pers. obs.).

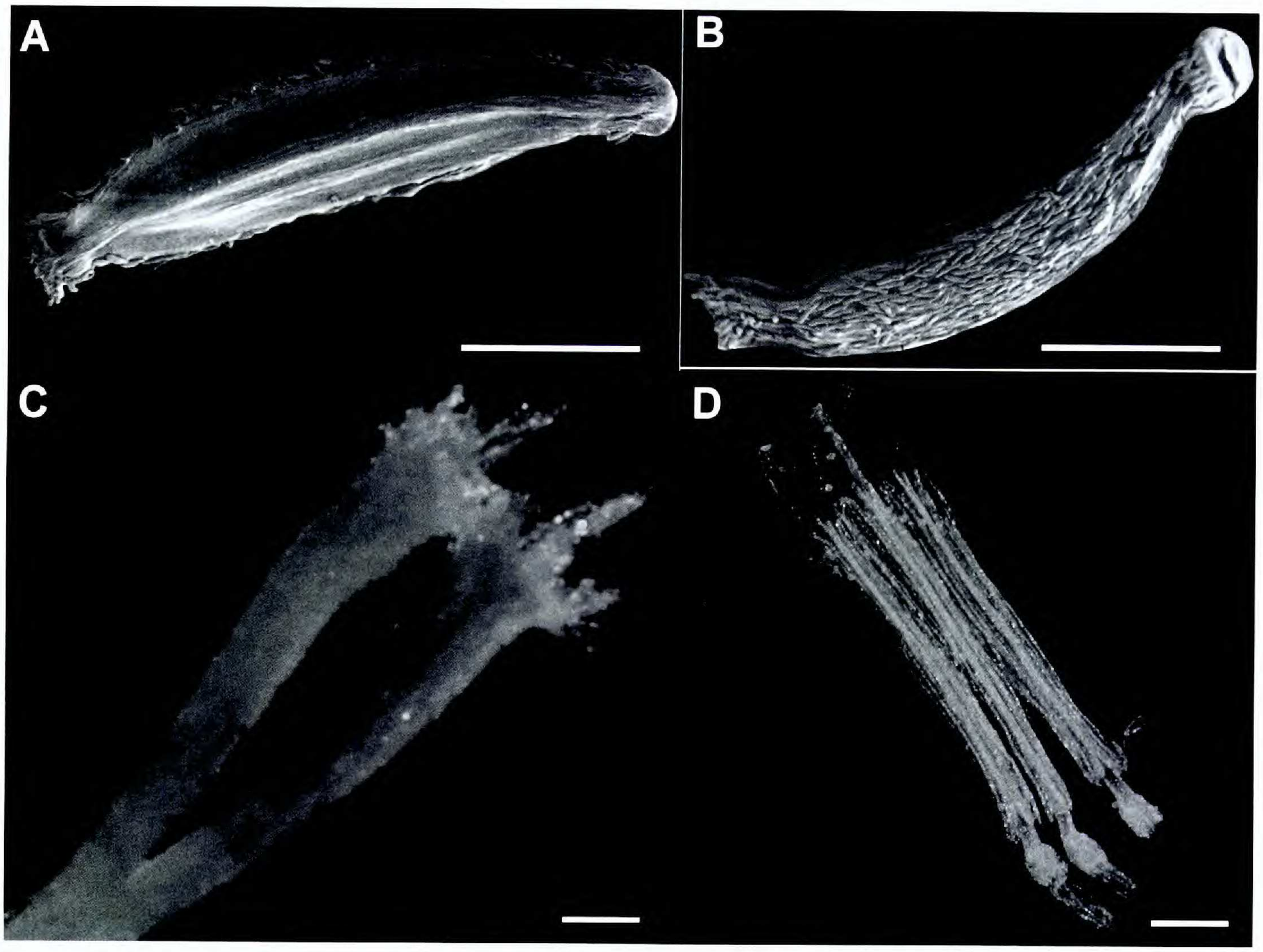

Figure 3. *Bolandia pedunculosa*. —A, B. Scanning electron micrographs of ray cypsela with glabrous inner surface and pubescent outer surface. Scale bars = 1 mm. —C. Truncate style apices with central tuft and fringe of sweeping hairs. Scale bar = 215 µm. —D. Stamens with ovate apical appendages and balusterform filament collars. Scale bar = 300 µm.

Stilpnogyne DC. is an ecalyculate monotypic genus from the Northern and Western Cape that also has cypselae of the same shape, color, and indumentum as *Bolandia* (i.e., black with all surfaces covered in short white hairs), but they are not heteromorphic. In addition, it differs from *Bolandia* by its palmately veined leaves and very small disciform capitula, with only 7 or 8 florets (vs. a minimum of 24 florets in *Bolandia*).

Endemism and conservation. The distribution and altitudinal range of *Bolandia* places it in the Cape Floristic Region, the boundaries of which are difficult to define because it extends into neighboring and other phytochoria and contains enclaves of other floristic regions (Van Wyk & Smith, 2001). Its core area is best defined in geological terms as the outcrops of the Table Mountain and Witteberg Groups of the Cape Supergroup (Van Wyk & Smith, 2001). The average altitude of the mountains is 1000–1500 m, with individual peaks over 2000 m. *Bolandia* tends to be associated with mountain fynbos (as opposed to renosterbos) and occurs mainly in fire-free sites at the base of cliffs, overhangs, and among rocks. The Cape Floristic Region is noted for its high levels of endemism (about 70%), including 210 endemic or near-endemic genera (Goldblatt & Manning, 2000; Van Wyk & Smith, 2001). *Bolandia* is yet another near-endemic genus, with a connection to the Drakensberg Afro-alpine centre, and *Bolandia argillacea* is endemic to the mountains near Worcester.

Up to 90% of the mountain fynbos in the Cape Floristic Region is protected in nature reserves and mountain catchment areas or by the inaccessibility of the terrain (Rebelo, 1994). This is in contrast to the lowlands of the Overberg and Worcester-Robertson Karoo Centre (i.e., below 600 m), where agriculture is a major activity and conservation of remaining natural vegetation is an issue requiring attention (Hilton-Taylor & Le Roux, 1989; Wood, 1991; Van Wyk & Smith, 2001). As noted previously, *Bolandia* occurs at high altitudes (at 1000 m and above), so its continued existence should not be under direct threat from man, although it should be noted that it is never abundant and climate change may have an adverse effect on all such montane vegetation.

Acknowledgments. We thank the University of the Witwatersrand Research Committee and the National

Research Foundation (NRF) of South Africa for funding toward this project, and the following herbaria for the loan of specimens and/or access to specimens and facilities on site: BM, BOL, BR, E, G-DC, J, K, NBG, NU, PRE, S, SAM, UPS, and US.

Literature Cited

Bremer, K. 1994. Asteraceae: Cladistics and Classification. Timber Press, Portland, Oregon.

Candolle, A. P. de. 1837–1838. Prodromus Systematis Naturalis Regni Vegetabilis VI. Treutel & Würtz, Paris.

Cron, G. V. 2005. *Cineraria* L. (Senecioneae, Asteraceae)—Its Taxonomy, Phylogeny, Phytogeography and Conservation. Unpublished Ph.D. Thesis. University of the Witwatersrand, Johannesburg.

Goldblatt, P. & J. Manning. 2000. Cape Plants: A Conspectus of the Cape Flora of South Africa. Strelitzia 9. National Botanical Institute of South Africa, Pretoria, and Missouri Botanical Garden Press, St. Louis.

Harvey, W. H. 1865. *Cineraria*. Pp. 307–314 *in* W. H. Harvey & O. W. Sonder (editors), Flora Capensis, Vol. 3. Hodges, Smith, Dublin; I. C. Juta, Cape Town.

Hilliard, O. M. 1989. Notes on some plants from southern Africa: XV. Notes Roy. Bot. Gard. Edinburgh 45: 185–187.

Hilton-Taylor, C. & A. Le Roux. 1989. Conservation status of the fynbos and karoo biomes. Pp. 202–223 *in* B. J. Huntley (editor), Biotic Diversity in Southern Africa: Concepts and Conservation. Oxford Univ. Press, Cape Town.

IUCN. 2001. IUCN Red List Categories and Criteria Version 3.1. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland.

Nordenstam, B. & P. Pelser. 2005. *Dauresia* and *Mesogramma*: One new and one resurrected genus of the Asteraceae–Senecioneae from Southern Africa. Compositae Newslett. 42: 74–88.

Potgieter, D. J. (editor). 1975. Encyclopaedia of Southern Africa. Volume 11: 406. Nasau, Cape Town.

Rebelo, T. 1994. Cape Floristic Region. Pp. 218–224 *in* S. D. Davis, V. H. Heywood & A. C. Hamilton (editors), Centres of Plant Diversity. A Guide and Strategy for Their Conservation, Vol. 1. IUCN Publications Unit, Cambridge.

Van Wyk, A. E. & G. F. Smith. 2001. Regions of Floristic Endemism in Southern Africa. Umdaus Press, Pretoria, South Africa.

Wood, J. 1991. Threats facing the Robertson Karoo. Veld Fl. 77: 16–17.